BIOGRAPHICAL SKETCH

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NAME: Amy Elizabeth Palmer

eRA COMMONS USER NAME (credential, e.g., agency login): AMYPALMER

POSITION TITLE: Associate Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Dartmouth College, Hanover NH	A.B.	1994	Biophysical Chemistry
Stanford University, Stanford CA	M.A.	2000	Science Education
Stanford University, Stanford CA	Ph.D.	2001	Chemistry
University of California San Diego, La Jolla CA	postdoc	2005	Pharmacology and Imaging

A. Personal Statement

My lab has extensive experience in protein engineering, expression of designed fluorescent probes in bacteria, yeast, and mammalian cells, biochemistry, cell biology, live cell imaging, and host-pathogen interactions. This work includes the development, validation, and application of tools, such as FRET-based sensors, development of new fluorescent proteins and fusion proteins, visualization of organelle dynamics, and the use of small molecule probes to interrogate and elucidate fundamental aspects of cell biology and biochemistry. We routinely work with a variety of mammalian cell culture systems, including primary hippocampal neurons, T-cells, and primary bone marrow derived macrophages. In addition, we have been developing systematic approaches for long-term imaging and subsequent quantitative image analysis. I have a strong track record of interdisciplinary and collaborative science, including joint publications and research grants (NIH and HFSP).

I am deeply committed to mentoring young scientists, from undergraduates through postdoctoral researchers. I have trained 10 postdoctoral research associates, including 8 women. 5 postdocs have finished their training and 5 are still in the lab. The postdocs who have finished their training have succeeded in obtaining excellent career positions: 3 in faculty positions at respected institutions (University of Colorado Denver, Texas Tech University Health Sciences Center, University of Denver, one of whom was an NIH K99 recipient); 1 senior scientist at a start-up company, and 1 in public health. I have also trained 15 PhD students, including 9 women and 2 underrepresented minorities. I have helped 4 of these students receive independent funding in the form of NIH F31 pre-doctoral training fellowships or NSF Graduate Research Fellowships. All of my PhD graduates have remained in the sciences. I have also mentored over 30 undergraduates, including 17 women and 7 under-represented minority students. I have served as a standing member of an NIH study section (MSFA) and as an ad hoc reviewer for a variety of other panels, including the New Innovator DP2 panel (2017, 2018). In addition, I have a strong track record of external funding, including NIH R01 grants, NIH DP1 Pioneer Award, NSF CAREER Award, and HFSP Program Grant, and feel confident in my ability to coach Colin in science writing and grantsmanship. I am on the Editorial Board of two journals (*Journal of Biological Inorganic Chemistry* and *Biophysical Journal*) and will leverage my experience to guide Colin through publishing, reviewing, and navigating interactions with editors. I have been an invited speaker at numerous national and international conferences related to cellular imaging and been invited to write several authoritative reviews on this topic.

Representative publications are listed below.

1. In new work, we have collaborated with the Batey and Gryko Labs to develop an RNA imaging platform called Riboglow that will serve as the foundation for Colin's F32 proposal. This work has been deposited in bioRxiv and is under revision. (https://www.biorxiv.org/content/early/2017/10/10/199240)
2. Dean, K.M., **Palmer A.E.**, Advances in fluorescence labeling strategies for dynamic cellular imaging, *Nature Chemical Biology*, 2014, 10(7): 512-23
3. VanEngelenburg, S.B., and **Palmer, A.E.**, General method for live-cell imaging of Type-III Secretion reveals effector dynamics and spatial segregation of three *Salmonella* effectors, *Nature Methods,* 2010, 7(4): 325-30
4. Qin, Y., Dittmer, P.D., Park, J.G., Jansen, K.B., **Palmer A.E.**, Steady state and dynamic measurements of endoplasmic reticulum and Golgi Zn^{2+} using genetically encoded sensors, *Proc. Natl. Acad. Sci. U S A,* 2011, 108(18):7351-6

B. Positions and Honors

Positions and Employment

1994-1995	Research Assistant, Dartmouth College Laboratory of Karen E. Wetterhahn, Ph.D.
1995-2001	Graduate Research Assistant, Stanford University Laboratory of Edward I. Solomon, Ph.D.
2001-2005	NIH Postdoctoral Fellow, University of California San Diego Laboratory of Nobel Laureate in Chemistry (2008) Roger Y. Tsien, Ph.D.
2005-2012	Assistant Professor, Chemistry and Biochemistry, University of Colorado, Boulder BioFrontiers Institute Member, Program in Neuroscience, Medical Scientist Training Program
2012-present	Associate Professor, Chemistry and Biochemistry, University of Colorado, Boulder BioFrontiers Institute Member, Program in Neuroscience, Medical Scientist Training Program
2013	Visiting scientist, Unité des Interaction Bactéries Cellules (Pascale Cossart Lab), Pasteur Institute, Paris, France

Honors/Awards

2017	Marinus Smith Award, CU Boulder
2016	Chancellor's Award for Excellence in STEM Education, CU Boulder
2016	ASSETT Faculty Development Award, CU Boulder
2014	NIH Director's Pioneer Award
2013	Human Frontiers Science Project Program Grant awardee
2010	NSF CAREER Award
2010	Alfred P. Sloan Foundation Research Fellow
2010	Ed Stiefel Young Investigator Award in Biological Inorganic Chemistry
2007	Whitehall Foundation Award
2004	Best poster invitational lecture, FASEB Conference on Calcium and Cell Function
2004	Pfizer Postdoc Poster Award, Gordon Research Conference in Bioorganic Chemistry
2003-2005	Ruth L. Kirschstein National Research Service Award, NIH Postdoctoral Fellowship
2000	Franklin Veatch Memorial Fellowship, Department of Chemistry, Stanford University

Service

2017	Editorial Board Member, *Biophysical Journal*
2015	Editorial Board, *Journal of Biological Inorganic Chemistry*
2015, 2017	External Advisory Committee, GENIE Project, Janelia Farm
2017, 2018	NIH DP2 study section member
2015	Co-Chair Elect (2015): Cell Biology of Metals GRC
2013	Co-Vice Chair Elect (2013): Cell Biology of Metals GRC
2010-2014	NIH MSFA (Molecular Structure and Function) study section member
2010	Organizer: Metals in Biology Symposium, ACS National Meeting Fall
2008-2009	Guest Editor *Chemical Reviews* "Cellular Metal Trafficking and Regulation" thematic issue
2008 - present	Grant Reviewer – NSF
2007-present	Summer Multicultural Access to Research Training (SMART) Mentor
2006-present	CU Biophysics Graduate Training Program, Steering Committee

Member: American Chemical Society, Biophysical Society, American Society for Cell Biology, Society of Biological Inorganic Chemistry, International Society of Zinc Biology

C. Contributions to Science

1. My lab has pioneered the development of genetically encoded fluorescent sensors based on FRET to quantitatively map the distribution of accessible zinc in mammalian cells. We targeted these sensors to a variety of intracellular locations including the cytosol, nucleus, mitochondria, ER, Golgi, and plasma membrane in order to obtain the first quantitative estimates of zinc in intracellular organelles. Using these sensors we established the existence of acute changes in zinc in response to signaling cascades, and systematic perturbations in zinc availability associated with disease. I was recently awarded an NIH Director's Pioneer Award (2014) to investigate the role of Zn^{2+} as a signaling ion. My contributions to the field of cell biology of metals have been recognized by my serving as Guest Editor for a *Chem Reviews* issue, organization of a symposia at National meetings (ACS and ASBMB), serving on the MSFA study section, and being elected Chair of the Cell Biology of Metals Gordon conference.

a) Carter, K.P., Young, A.M., **Palmer, A.E.**, Fluorescent Sensors for Measuring Metal Ions in Living Systems. *Chem. Rev.,* 2014, 114(8):4564-601

b) Carter, K.P.*, Carpenter, M.C.*, Fiedler, B.L., Jimenez, R., **Palmer, A.E.**, Critical comparison of FRET-sensor functionality in the Cytosol and Endoplasmic Reticulum and Implications for Quantification of Ions, *Anal. Chem.,* 2017, 89(17):9601-9608,

c) Qin, Y., Dittmer, P.D., Park, J.G., Jansen, K.B., **Palmer A.E.**, Steady state and dynamic measurements of endoplasmic reticulum and Golgi Zn^{2+} using genetically encoded sensors, *Proc. Natl. Acad. Sci. U S A,* 2011, 108(18):7351-6

d) Qin, Y., Sammond, D.W., Braselmann, E., Carpenter, M.C., **Palmer, A.E.**, Development of an Optical Zn^{2+} Probe Based on a Single Fluorescent Protein, ACS Chem. Biol., 2016, 11(10): 2744-2751, PMID: 27467056

2. My lab has developed methodologies and approaches for understanding the interface and dynamics between bacterial pathogens and host cells. In particular, we have developed two methodologies for imaging Type III Secretion (i.e. translocation of bacterial effector proteins or virulence factors into the host cell cytosol) using the in situ chemical labeling reagent FlAsH/tetracysteine and split-GFP. In addition, we have established techniques for long-term (> 24 hour) time lapse imaging of infections, including those of primary bone marrow derived macrophages.

a) McQuate, S.E., Young, A.M., Silva-Herzog, E., Bunker, E., Hernandez, M., de Chaumont, F., Liu, X., Detweiler, C.S., **Palmer, A.E.**, Long-Term Live Cell Imaging Reveals New Roles for Salmonella Effector Proteins SseG and SteA, *Cell Microbiology*, 2016, Jul 4. doi: 10.1111/cmi.12641.

b) VanEngelenburg, S.B., and **Palmer, A.E.**, General method for live-cell imaging of Type-III Secretion reveals effector dynamics and spatial segregation of three *Salmonella* effectors, *Nature Methods,* 2010, 7(4): 325-30

c) Young, A.M., Minson, M., McQuate, S.E., **Palmer, A.E.,** Optimized fluorescence complementation platform for visualizing *Salmonella* effector proteins reveals distinctly different intracellular niches in different cell types, *ACS Infectious Disease,* 2017, 3(8):575-584,

d) Stavru F, **Palmer AE**, Wang C, Youle RJ, Cossart P., Atypical mitochondrial fission upon bacterial infection, *Proc Natl Acad Sci U S A.* 2013, 110(40):16003-8, PMID: 24052378

3. In collaboration with Professor Ralph Jimenez (JILA/NIST/U. Colorado), we have designed and implemented optically integrated microfluidic technology for high throughput characterization, screening, and selection of cells on the basis of a fluorescence change in a time resolved manner. In the course of this work we developed the first cell sorter based on FRET for optimizing and characterizing sensors, the first multi-parameter cell sorter capable of measuring fluorescence lifetime and photostability for optimizing the photophysical properties of fluorophores, and a joint-R01 grant between Ralph and myself. We are now applying these novel cell sorters to monitor fluorescence changes in biological assays such as ion flux in yeast deletion libraries, activation of signaling by receptor-ligand binding, and evolution of new fluorescent proteins with improved photophysical properties.

a) Fiedler B.L., Van Buskirk S., Carter K.P., Qin Y., Carpenter M.C., **Palmer A.E.**[*], Jimenez R.[*], Droplet Microfluidic Flow Cytometer For Sorting On Transient Cellular Responses of Genetically-Encoded Sensors, *Anal. Chem.*, 2017, Jan 3;89(1):711-719.

b) Ma, H., Gibson, E.A., Dittmer, P.J., Jimenez, R.[*], **Palmer, A.E.**[*], High-throughput Examination of Fluorescence Resonance Energy-Detected Metal-ion Responses in Mammalian Cells, *J. Am. Chem. Soc.,* 2012, 134(5):2488-91

c) Dean, K.M., Lubbeck, J.L., Binder, J. Schwall, L.R., Jimenez, R.[*], **Palmer A.E.**[*], Analysis of Red-Fluorescent Proteins Provides Insight into Dark-State Conversion and Photodegradation, *Biophysical Journal,* 2011, 101: 961-969

d) Davis L.M., Lubbeck J.L., Dean K.M., **Palmer A.E.**, Jimenez R., Microfluidic cell sorter for use in developing red fluorescent proteins with improved photostability, *Lab Chip*, 2013, 13(12):2320-7

4. As a post-doc with Professor Roger Tsien, I developed a sensitive and versatile family of genetically encoded (FRET-based) sensors for calcium ("D-family" cameleons). As an independent investigator, my lab has used these sensors on our own and in collaboration to visualize organelle pools of calcium, and track how subtle changes in organelle pools are associated with diseased states. Application of these sensors to the age-old question of how calcium is taken up into mitochondria led to characterization of MICU1, the first identified regulator of the mitochondrial uniporter.

a) Perocchi, F., Gohil, V.M., Girgis, H.S., Bao, X.R., McCombs, J.E., **Palmer, A.E.**, Mootha, V.K., *MICU1* encodes a mitochondrial EF hand protein required for Ca^{2+} uptake, *Nature*, 2010, 467(7313):291-6

b) Sek Tong Ong, D., Mu,T.W., **Palmer, A.E.**, and Kelly, J.W., Endoplasmic Reticulum Ca^{2+} Increases Enhance Glucocerebrosidase Folding, Trafficking and Function, *Nature Chemical Biology*, 2010, 6(6):424-32

c) Qin, Y., Dittmer, P.D., Park, J.G., Jansen, K.B., **Palmer A.E.**, Steady state and dynamic measurements of endoplasmic reticulum and Golgi Zn^{2+} using genetically encoded sensors, *Proc. Natl. Acad. Sci. U S A,* 2011, 108(18):7351-6

d) **Palmer, A.E.**, Giacomello, M., Kortemme, T., Hires, S. A., Lev-Ram, V., Baker, D., Tsien R. Y., Ca^{2+} indicators based on computationally-redesigned calmodulin-peptide pairs, *Chemistry and Biology*, 2006, 13: 521-530

D. Research Support

NIH DP1 award DP1GM114863-01
Regulation of cell signaling by transition metal dynamics
Grant duration: 9/1/2014 – 8/31/2019
Role: PI

NIH R01 award GM084027-06
Genetically encoded sensors shed light on zinc homeostasis
Grant duration: 9/1/2013 – 5/31/2018
Role: PI

NIH R01 R01 GM105997
Technologies to Define and Map Novel Interorganelle Macromolecular Interactions
Grant Duration: 8/1/2013 – 04/30/2018
PI: Natalie Ahn
Co-PIs: Amy Palmer, Vladislav Verkhusha (Albert Einstein M.C.)

NSF Major Research Instrumentation DBI 1429782
MRI: Development of an Advanced Bio-Imaging Instrument: Enabling 3D quantitative multifunctional sensing at the nanoscale
Grant duration: 8/15/2014 – 8/31/2017
PI: Rafael Piestun
Co-PI: Amy Palmer